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ABSTRACT

THIS MANUAL WAS PREPARED FOR ELEMENTARY SCHOOL TEACHERS AS PART OF THE SCIENCE PROJECT RELATED TO UPGRADING CONSERVATION EDUCATION (PROJECT S.P.R.U.C.E.). THE INTRODUCTION EMPHASIZES THE IMPORTANCE OF AN INTEGRATED APPROACH TO ENVIRONMENTAL EDUCATION, AND LISTS SOME RESEARCH FINDINGS IMPORTANT IN PLANNING INSTRUCTION. A CHART SHOWS RELATED UNDERSTANDINGS FROM SCIENCE AND SOCIAL STUDIES KEYED TO GRADE LEVEL. NINE PROBLEM AREAS ARE CHOSEN, AND IN EACH AREA TWO PROBLEMS ARE SUGGESTED FOR INVESTIGATION OR DISCUSSION AT EACH GRADE LEVEL. PROBLEM AREAS ARE: THE CONCEPT OF CHANGE; PLANTS; ANIMALS; OUR GROWING BODIES; AIR, WATER, WEATHER; EARTH AND ITS COMPOSITION; SOLAR SYSTEM AND BEYOND; AND MATTER AND ENERGY. MOST OF THE PROBLEMS LEAD STUDENTS TO OUTDOOR INVESTIGATIONS. THE WORK WAS PREPARED UNDER AN ESEA TITLE III CONTRACT. (EB)

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SOME PROBLEMS FOR THE TEACHER USEFUL AS A BASIS FOR PLANNING LESSONS IN SCIENCE-CONSERVATION

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INTRODUCTION

Every teacher is confronted with the daily task of planning and teaching lessons which are reflective of his knowledge of subject matter and of how children learn. Each day the elementary school teacher prepares to teach in a number of subject areas with definite goals in mind.

What observable pupil behavior might be expected from a given class presentation? On what cognitive functions should he concentrate? What skills? What processes of science? How should the teaching be designed to achieve these aims? The expected outcomes should be defined since they help to determine the instructional procedures. It is not always possible to predict or to observe behavioral changes because the unpredictable and immeasurable so frequently happen. But this is the only way we have at present to measure the learning results of teaching.

In the teaching of science upon which we are focusing, special considerations are added. In order to understand the objects and events of the world in which we live we must include learning experiences which extend outside the classroom, beyond the doorstep so as to embrace the total environment. The entire school site becomes a laboratory for learning - in, out, all around. There is really no such thing as "outdoor education" as opposed to "indoor education", "Education" must include both inside and outside.

Furthermore, by teaching about the interrelationships among living things with each other and with their non-living environment we find that this ecological approach leads to a development of concepts in conservation. Thus, there is no such thing as a discipline "conservation". Good education helps to develop those attitudes and values which should culminate in actions designed to maintain or improve conditions on our planet and each subject must contribute to this end.

Frequently it is best to integrate science with social studies (see page 2). At other times there are advantages to cutting across other disciplines. This interdisciplinary approach is inherent in the new curriculum developments under the heading, "environmental education". What is environmental education? We might say that good education is environmental. It helps to develop concepts which will aid in environmental improvement, it provides for investigations in indoor and outdoor environments, it utilizes the best of what we know about children and what they learn.

The New York State elementary science program is divided into six subject matter areas. Several series of workshops for elementary teachers in the Mid-Hudson Catskill Region have been given by Project S.P.R.U.C.E. over the past several years, using this curriculum as its basis. For each science area a set of two problems per grade for

the teacher was developed. Many more problems could be added. The two which are stated are merely by way of example and to set the thinking along lines of problem-solving.

With this as a start the teacher can proceed to develop a series of lesson plans for his class. The grade placement is merely suggestive and is based on guidelines set forth in the curriculum.

A possible outline for a lesson incorporating the recommendations above might be:

I Content Objectives	II Processes	III Method of Instruction	IV Behavioral Outcomes
Outline Content - The points you wish to make	The kinds of thinking you select to stress with proposed content and method - (Science process skills and methods of inquiry are thought to develop certain cognitive abilities). Ex: analysing, making deductions, recalling, inductive reasoning, comparing, classifying, categorizing, inferring, predicting (hypothesizing), thinking reflectively, thinking critically, generalizing, describing, making a value judgment, relating one thing to another, observing	What do you plan to do to achieve I, II, IV?	What do you want your students to do as a result of your methods, the subject matter, the place where you teach? Indicate behaviors related to science, social studies, conservation, outdoors, etc. explaining, planning an experiment, controlling variables, measuring, reading, using equipment skills, making new discoveries outdoors, using the school site for investigations.

Note: Outline Column I first. Then do Column II. Column IV follows next. Then decide on how to achieve your goals by completing Column III.

Some conclusions based on some of the most recent researches are pertinent here; (These are taken from a summary list from Science and Children, April, 1969, page 33.)

1. "Instructional procedures, whether in the classroom or in the research situation, should be based on some clearly defined model of what constitutes the instructional process. The major criteria for such a model should be that it is useful in helping understand the components of instruction and that the instruction develops desired behavior changes in pupils."

2. "For teachers skilled in handling them, problem-solving or inductive methods or instructional procedures designed to improve creativity can bring about gains in outcome areas which are greater than if more traditional approaches are used. This is not achieved at the expense of knowledge of content."

3. "Audiovisual aids and reading materials should be carefully integrated into the instructional sequence for a definite instructional purpose, otherwise little effect on achievement outcomes will be noted."

4. "Pupil activity and pupil performed experiments are important prerequisites for the effective learning of science concepts. This seems true for all levels of ability."

5. "Instructional procedures can be devised to bring about specific outcomes, provided these outcomes are clearly defined. Both problem-solving skills and creativity can be developed."

6. "Verbalization of a concept is the last step in a child's understanding of it. He can demonstrate aspects of his understanding in concrete situations long before he can verbalize them."

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Understandings from Elementary Science & Social Studies Curricula

GRADE	SCIENCE	SOCIAL STUDIES
K	There are many kinds of plants and animals. Air is all around us.	Immediate environment.
1	Animals live in many kinds of places. Rain and snow come from water vapor (clouds) in the air.	Related to study of basic industries such as farming.
2	Green plants supply food. Water evaporates from many places and returns to the air.	In study of city and rural areas can bring out interdependence of rural and urban life.
3	Plants and animals are adapted to live in their environments. The surface of the earth is constantly changing.	Study of different communities - desert, forest, etc.
4	Plants and animals reproduce other plants and animals like themselves. The surroundings of living things are always changing.	Study of various ethnic groups, their migrations.
5	Living things depend upon green plants. The growth of plants depends principally upon topsoil.	The study of major regions and how the people make a living - soil conditions, etc.
6	Plants and animals live together in communities. What does a naturalist investigate? (Careers)	Study of major regions in eastern hemisphere - climate, topography, vegetation. Many plants and animals are transported and transplanted.

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Some Problems for Lessons Concerning the Concept of Change

Grade

K
- I. What happens to the size of a dripping icicle as it melts? How many drops are lost each minute?
- II. Listen to the sound that your footsteps make as you walk on different surfaces: on hard paved ground, on unpaved ground, on grass, on covered ground and through a pile of leaves? How does the sound of your footsteps change?

1
- I. How do your teeth change from the time you are born until you are a grownup?
- II. Where are there dry spots outdoors that change to puddles after a rain?

2
- I. How do plants outside change in the spring and fall? (Include Trees since they are plants) Compare to changes in potted plants indoors.
- II. How does the temperature change from day to day inside your room and outside, at a certain time of day?

3
- I. What changes do you find in the snow on each side of your building after a snowfall?
- II. What changes do you notice in your classmates and about yourself after you have taken a slow walk around your school? What changes do you notice after a brisk walk around the school?

4
- I. Into how many forms can you change water? If you use the same amount of water for each form how do the sizes of each form compare to each other?
- II. How do the annual rings of a tree stump show changes which took place in the life of the tree?

5
- I. What changes do you observe about the air outside your school within 10 minutes, 30 minutes, at three different times of the day, on different days of the week at the same hours?
- II. What reactions can you find between living things and any of these changes as they take place?

6
- I. What changes take place in a tree after it falls?
- II. What kinds of changes which are due to weather can you find on the outsides of buildings? How might such changes be prevented?

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Some Problems for Lessons in the Area, "Living Things: Plants"

Grade

K
- I. Where are the trees whose leaves fall as winter comes? Where are trees which are green all year, winter and summer?
- II. Where around the school do you find trees which are used by birds? How do the birds use the trees?

1
- I. Where, outside your school, is a good place to plant seeds? Why is the place good? Plant a few kinds and see which grows fastest.
- II. Find one kind of plant which grows in many places outside of your school.

2
- I. Where, around the school, are young trees? Where are grownup trees?
- II. What kinds of animals do you find in and around trees? What are they doing?

3
- I. How do people help to make plants grow? What kinds of plants grow outside which were planted by people? How do they take care of them? Where are plants which receive no care by people? How do you know?
- II. What part of the area outside your school could be made more attractive with growing plants?

4
- I. What evidence of next year's trees can you find on the trees at each season?
- II. What kinds of plants grow both in sunshine and shade? Compare any one or more of these. Which look healthier, have longer stems, larger leaves, more flowers, deeper roots?

5
- I. Do trees grow taller from the bottom of the tree or from the top of the tree? How does the tree get wider? How does the bark of young trees compare with the bark of older trees?
- II. What kinds of changes do the leaves of any selected tree outside your school show each month? What changes in bark are observed?

6
- I. On which type of tree in your area do the branches grow quickest? slowest?
- II. What kinds of animal life can you find in a handful of leaves collected from a corner or against the wall of your school building?

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Some Problems for Lessons in the Area, "Living Things: Animals

Grades

K I. What animals can we find outside our school?

II. What kinds of dogs live in your neighborhood?

1 I. Are there more animals over our heads or down on the ground?

II. When do you find more earthworms on the ground - before it rains or after a rainfall?

2 I. What animals live in and around trees?

II. Look for all kinds of holes in the ground. How do you know which are ant holes, earthworm holes, snake holes? What other kinds of holes do you find?

3 I. What animals can we find down on the ground, at eye level, overhead?

II. How do earthworms make the soil more airy?

4 I. How long do you have to wait before you see an animal in the air?

II. Are earthworms more active by day or by night?

5 I. What evidences or clues can you find of animal life around the school?

II. What kind of food is most attractive to a flock of pigeons near the school?

6 I. What have you found to be the most successful way to attract animal life outside your school?

II. How many earthworms do you estimate to be in your school yard (or lawn)?

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Some Problems for Lessons in the Area, "Our Growing Bodies"

Grade		
K	I.	What grows faster, a bean seed or you?
	II.	Where are woollybears found? What is their shape when they move? when they are touched?
1	I.	Compare the front teeth of babies less than 6 months of age with babies from 6 months to 1 year, with 1 year olds, 2, 3, 4, 5, 6, 7, 8, 9, 10 year olds.
	II.	What do woollybears eat? Do they drink water?
2	I.	How much do you grow each week?
	II.	How big are woollybears?
3	I.	How does the size of children of the same age vary? How does the weight of children of the same age vary?
	II.	Do woollybears feed at night?
4	I.	Which shrub grows taller, one that is pruned or one which is not pruned?
	II.	At what temperature are woollybears most active?
5	I.	How does a tree increase in height, from the top or bottom? How does it increase in diameter?
	II.	What indoor conditions are best for hibernating woollybears? Where do you find them outdoors in early fall, late fall, early spring, late spring?
6	I.	How does age affect the pulse rate? sex? time of day? kind of activity?
	II.	In what direction do woollybears travel? What variation in direction is there at different times of day? Where and when are woollybears most abundant?

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Some Problems for Lessons in the Area, "Air, Water, Weather: Emphasis on Air"

Grade		
K	I.	In what kinds of places do you find air?
	II.	When do you breathe in more air, when you sit quietly or when you run?
1	I.	What kinds of work can be done by air?
	II.	Where around your school are chimneys? What is the color of the smoke which comes out of chimneys? Who breathes in air with this smoke?
2	I.	Where does most litter collect because of the wind?
	II.	Scrub a part of an outside step or pavement. Compare the cleaned part with the uncleaned part. From where does the dirt come?
3	I.	Which is the windiest side of your school?
	II.	If you hang five white tissues on a clothes line on Monday and take one tissue off each day, which is the cleanest? the dirtiest? From where does the dirt come?
4	I.	How does the direction of cloud movement compare with the direction of air around you at different times of the day and on different days?
	II.	What kinds of particles are collected on greased slides or dishes exposed to the air over a period of a day, a week, or more?
5	I.	Where are most earthworms found after a rain? What might this have to do with air? How do fish get air? How do plants get air?
	II.	How do the amounts of unburned particles which are collected from car exhaust pipes from several different cars compare?
6	I.	Why does a smoke-filled room make you cough? What happens to such smoke outdoors in the country? in the city? Where is it worse? Why?
	II.	How can you get rid of the black deposit produced on a white dish (or other surface) by the flame of a burning match or lighted candle? What use is being made of this knowledge to control air pollution from vehicles?

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Some Problems for Lessons in the Area, "Air, Water, Weather: Emphasis on Water"

Grade		
K	I.	How do boots keep your feet dry in the rain and snow?
	II.	What happens to the rainwater which collects in puddles after a rain?
1	I.	Which material is the most rainproof?
	II.	How deep is the snow around your school?
2	I.	Are there any plants or animals under the snow?
	II.	How can you tell from the sky when it is going to rain?
3	I.	Where does the snow melt quickest around your school?
	II.	Where are there puddles around your school after a rain?
4	I.	How do the sizes of raindrops vary at different times during a rainstorm?
	II.	How much water is being wasted by a dripping faucet in school or home?
5	I.	What kinds of snow crystals are produced at the beginning and at the end of a snowstorm?
	II.	What is the most economical way in which you can use a gallon of water before discarding it?
6	I.	Which of the following foods has the largest amount of water: beans, apples, celery, bread, butter?
	II.	What evidences of weathering do you find around your school?

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Some Problems for Lessons in the Area, "Earth and Its Composition"

Grade

K I. Which is a harder material, rock or soil?

II. Where is the biggest rock outside your school? Where is the smallest?

1 I. Where is stone used indoors? outdoors?

II. Where in the soil outside, are earthworms living? What else lives in the soil?

2 I. What covers the ground outside of the school? (Look for paved areas, gravel, black-top, sand, soil, grass, etc.)

II. Where are there more plants growing outside in the sandy playfield or in the darker soil which is not a playfield? Why?

3 I. What is under a paved area outside?

II. What uses are made of materials from the earth such as stone, brass, iron, cement, chalk - inside and outside?

4 I. What part of the ground outdoors is covered with man-made materials? What are these materials?

II. What happens to rainwater when it falls on bare soil, rock, grass-covered soil, pavement? (Look for changes in color, smell, texture, rate of evaporation)

5 I. Can you find any evidence that soil comes from rocks and that rocks come from the earth?

II. Where in the school neighborhood has limestone or a limestone product been used? (Limestone fizzes with vinegar.)

6 I. Where, around your school, can you find evidence that rock is becoming soil? that parts of structures built by man are becoming soil? What else do you find in samples of soil besides pieces of rock?

II. Which kind of soil outside retains most water? Which kind retains least?

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Some Problems for Lessons in the Area, "Solar System and Beyond"

Grade		
K	I.	Which is warmer, a shady spot or a sunny spot?
	II.	Which is the brightest side of your school? How can you tell?
1	I.	What is the difference between shadows which you make on a cloudy day and those you make in sunshine?
	II.	At what time of the day is your shadow longest? shortest?
2	I.	What is the shape of shadows made by the sun outdoors?
	II.	How do cats, dogs, birds act outdoors in winter? in spring?
3	I.	Is it warmer near the earth or away from the earth?
	II.	What could astronauts eat when they get to the moon?
4	I.	Which area around the school never receives direct sunshine? What grows there?
	II.	How fast do shadows move?
5	I.	How does the absence of air on the moon prevent the sun's rays from keeping the moon warm at night?
	II.	What is the composition of white light as seen when it passes through a prism? How does this compare to sunlight which passes through a prism?
6	I.	How much warmer is it inside a car than outside? What happens to the solar radiation after it enters the car?
	II.	Does the amount of light (as measured by a light meter) affect the kinds of plants which grow around the school?

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Some Problems for Lessons in the Area, "Matter and Energy"

Grade		
K	I.	What color is sunlight?
	II.	What kinds of things do you touch when you touch sunlight?
1	I.	What feels warmest when you stand in the sunlight - the air over your head, the air above the ground, the ground itself, or your shoes?
	II.	What kinds of materials (matter) do you find outdoors which are not indoors?
2	I.	How good are you at guessing whether you are in the sun or shade when you are blindfolded in a spot which has some sun and some shade?
	II.	In what forms is water present indoors? Outdoors?
3	I.	What evidences of changes in color due to sunlight do you find inside the classroom? Outside? Can you explain why there are more in one place than in the other?
	II.	What is the biggest and the littlest thing you can see outside when you face north, south, east, west?
4	I.	How much difference is there in the temperature between the shady side of the school and the sunny side, between the ground shaded by a tree and the ground in the sunshine, between the shaded portion of the playground and the sunny part of the playground?
	II.	Which of several different substances that are placed in the sunshine heat up most in a given period of time?
5	I.	What happens to the temperature of the air in a space enclosed by glass through which the sun shines?
	II.	How much of newer buildings are built of glass than other buildings? How does that affect the people inside in each case?
6	I.	How do the sizes of the surface areas of leaves of plants which grow both in bright sunlight and in shade compare?
	II.	What evidence can you find of animals depending on green leaves for food?

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